PLANTERS' BULLETIN

OF THE RUBBER RESEARCH INSTITUTE OF MALAYA

NEW SERIES NUMBER TWENTYSEVEN

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Legume Covers

Three articles on legume covers which appeared in *Planters' Bulletin 13, 14* and *17* have been collected together and reprinted in the September issue of *The Planter*. This is especially welcome as the first two articles, 'Covers and Weeding' and 'Establishing a Legume Cover', are no longer available from us. The latter deals with seed mixtures, treatment to promote germination, inoculation with root nodule bacteria, sowing and manuring; it is a reference much in demand. The third article is on 'Further Legume Covers'. This trilogy is complementary to our manual *The Uses and Control of Natural Undergrowth* (second edition available, price $2), which contains some eighty full page drawings for identification.

THE COVER DEPICTS AN EXAMINATION OF SECONDARY LEAF FALL SPECIMENS SENT TO OUR PATHOLOGICAL DIVISION IN RESPONSE TO AN ANNUAL CIRCULAR.

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Kuala Lumpur November 1956 Number 27

Editorial: Protection of Hevea

The growth of a tree depends on the complex of interactions between climate, soil, and biological factors in all their manifold aspects of association, competition, parasitism and predation. It is hardly possible to believe that all these factors can ever be fully understood, though the larger influences are known for the major crops. Thus we know most if not all of the diseases and pests that can attack the rubber tree. To some degree that knowledge extends to the second order – to the factors that limit these parasites themselves. We know their distribution. We know that when hevea was brought east it left behind the parasitic fungus *Dothidella ulei* which, as South American leaf blight, is the greatest enemy of plantation rubber. It is generally true of crop plant or weed, of pest or disease, of any organism whatever, that it flourishes best when first introduced into a new territory, before its enemies catch up with it.

This situation leads to two lines of action. One, where we are dealing with a weed or a pest, is to search in its original home for enemies that can be introduced into the new place to help control it. Great care is taken to ensure that any organisms brought in will not themselves be harmful in any way. The second line of action, where a crop has been established in a new place, is to keep it free of its enemies for as long as possible. The initial establishment should, of course, have been made with perfectly healthy plants. Action of this sort needs to be international. Though there are some countries which have boundaries that are also physical barriers, most national frontiers cut right across regions which are continuous from the point of view of the distribution of plants and animals. Countries that lie within the same region need to combine in their defence against common enemies of this sort. The difficulties of securing international agreement are such that little can be expected unless danger is felt to be real and serious

Several factors, local and general, have stimulated action. First, there is the increase in air travel, spreading a network of fast transport channels over the globe. Second, world opinion is moving towards international cooperation in technical matters. Third, that South American leaf blight of hevea is a plant disease hazard of the greatest consequence is a spur to action in all eastern countries where rubber is grown. In 1948 we represented to the Government the need for regional international agreement designed to exclude *Dothidella ulei*. The region was foreseen as including the whole of the commercial rubber growing areas of the east. Africa was not included although rubber is grown there on a large scale in the tropical west, because the African continent is a distinct and separate region and one which, at that time, was negotiating its

own regional phytosanitary agreement. As a result of the recommendations of the Federation of Malaya, a conference of technical representatives from countries in the South East Asia and Pacific Region was convened by the United Kingdom Government. The conference, which took place in Singapore in April 1949, endorsed the recommendation for an agreement and made detailed proposals. Though no formal agreement arose from the meeting it did lead some countries to revise their plant protection legislation.

New proposals for internatianal agreement were made in 1954 under the auspices of the Food and Agriculture Organization of the United Nations. The Plant Protection Meeting convened in Singapore by FAO in December of that year recommended a conclusion of the Plant Protection Agreement under the International Plant Protection Convention of FAO. Now the Director General of FAO has announced that the agreement came into force on 2 July of this year, with the signatures of nine governments. This is a notable step forward.

Next, a regional Plant Protection Committee will determine procedures and concert action on any important problem. The most immediate task is for them to ensure proper control over plant importation which, in the absence of phytosanitary precautions, might endanger crops grown in this part of the word. The agreement concerns rubber in that no hevea material will be imported into the region unless stringent safeguards and precautions are applied. From a region where *Dothidella ulei* occurs, no plant of any kind can be freely imported, and hevea only after quarantine at an intermediate place which is disease free.

But conditions for importation into Malaya are not to be made more rigorous than hitherto. The Director of Agriculture of the Federation has full powers for controlling plant imports and has for many years insisted on precautions quite as strict as those now agreed internationally.

The future of the industry is being safeguarded.

Effect of Manuring on Growth and Yield

A collective statistical treatment of seventeen long term experiments on the effect of manuring on growth and yield permits a few general conclusions to be drawn before full publication. Planting, budding and some manuring were carried out in 1938-40, but the trees were not tapped until 1946-48, when also manuring was resumed. Clones included PB 86, Tjir 1, Pil B84, Gl 1.

Girth records over six years between 1948 and 1955 showed that the most notable response was to phosphate, which caused an average increase of 4% per annum. This response was most marked at about thirteen years of age.

The nitrogen had less effect, while potassium had no significant effect on girth.

Yield recording over four years up to 1954 or 1955 mainly showed a significant response to phosphate. Nitrogen produced some effect when supplied with potassium.

Drainage of Low Coastal Areas

We have pleasure in presenting a guest article from the Drainage and Irrigation Department, Federation of Malaya, who have a special responsibility in the improvement of planting conditions on rubber estates, by the mitigation of flooding and the exclusion of tidal water.

THE COASTAL PLAINS OF MALAYA are flat and low lying and considerable areas are below the level of high tides. The river valleys, which are often planted in their flood plains, are narrow and steepen rapidly as they penetrate inland. Annual rainfall is high throughout the peninsula, being about 100 inches in the plains. Local variation is exemplified in the article 'Correct Timing' in *Planters' Bulletin 26* (page 85). The north east coast is influenced by the north east monsoon and has wet and dry seasons, but the west coast is but little influenced by the south west monsoon. Both monsoons have some effect in the south of the peninsula. Torrential rain is common throughout Malaya, and a rainfall of four inches in a day is not out of the ordinary.

Much of the west coast strip in the south is cultivated with rubber. This land has been developed from flat mangrove swamp which is tidal. The soil is soft sticky clay and is rich when sea water has been excluded.

Malaya has been developed relatively recently; settlement and cultivation of the coastal plain naturally started near the sea and up the tidal creeks where access was fairly easy. The early settler bunded himself off from the sea and drained his land by means of an artificial drain or a small natural creek, which passed through his bund at a rudimentary tidal control gate. By degrees the strip of coastal development became more or less continuous. Adequate provision was seldom made to dispose of flood water from the jungle of the hinterland through the strip of coastal cultivation. The natural drainage channels and the flood plains were constricted by the estate protecting bunds, flood levels were raised and the flood water pouring into the bunded areas breached the coastal defences from within. Finally tidal salt water entered through the breaches and damaged cultivation. As the clearing of jungle was extended inland the capacity of the catchments to absorb rainfall decreased and still higher peak floods resulted. The outlet drains to the sea – already constricted – became hopelessly overloaded, control gates at the coastal bund failed, the drains scoured out and served as passages through which tidal water penetrated far inland. The problem became beyond the capacity of the individual land owner and could only be solved by drainage schemes designed on a catchment basis. The design and implementation of these schemes is one of the major responsibilities of the Drainage and Irrigation Department.

Coastal drainage schemes have much in common. The section of land to be protected is usually bounded on the west by the sea, on the east by the hinterland, and to the north and south by tidal creeks which separate it from adjoining areas. An internal drainage system connects to one or more control gates which discharge flood water at low tide.

At high tide the control gates are closed. The system may be designed to accept drainage from the hinterland when this is not too great, but high level drains with special outlets are necessary where the drainage water from large areas of hinterland is to be denied entrance into the cultivated land.

CONSTRUCTION AND MAINTENANCE OF BUNDS

Apart from the high level drains, these schemes do not differ in principle from the efforts of the early settlers. The practical problems have increased, however. Construction and maintenance of bunds on land below tide level is no easy matter. The soil, a soft clay, often runs like porridge when first dumped. A bund may have to be worked over two or three times before it attains the desired level. The maximum height for a bund on ground below high tide level is limited, and is not much above spring tide level. Too high a bund results in lateral flow of the ground beneath, and the bund subsides. Present practice is to locate the borrow pit – from which the soil for the bund is excavated – on the inland side of the bund, where it forms a fresh water drain which cannects with the inland system. Damage to bunds by burrowing crabs and lobsters can be severe. Experience teaches that this can best be controlled when the land immediately outside the bund is as free as possible of brackish pools and channels.

In deciding how near to the sea or a tidal river a protecting bund may be built, two main factors have to be considered: first, the value of the land which is to be protected; second, the cost of construction and maintenance. The first should not be difficult to assess and the second will vary according to the need for protection from wave action. the level of the land, and the nature of the soil. The coasts of Malaya are subject to strong onshore winds which build up considerable waves. No earth bund can withstand the action of waves for long, so natural protection is needed between bund and open sea. At least five chains – and preferably ten chains – of mangrove protection are necessary to kill wave action. The lower the lie of the land below high tide level and the softer the soil, the bigger the bund has to be and the more expensive it is to maintain. Some estates have found small hand built bunds satisfactory provided that crabs, if present, are frequently poisoned*, and that the bunds are regularly maintained. But maintenance usually involves expensive hand labour, and where crab damage is prevalent only the machine built bund is satisfactory in minimising maintenance requirements. The construction of even a machine built bund is a doubtful economic proposition on land much below high neap tide.

To protect land from inundation at high spring tides, a satisfactory bund would normally be six feet wide at the top, with side slopes of

* *For this purpose a solution of Gammexane in Diesoline has been found most suitable, to date. Two and a half ounces of the dispersible powder (6½% gamma benzenehexachloride) in a gallon of Diesoline; apply at the rate of a tenth of a pint to each hole.*

at least 2 to 1 (preferably 3 to 1). The distance between the toe of the bund and the borrow pit drain should be at least 40 feet. Whether to construct a small hand built bund near the spring tide line, or a substantial bund lower down, is an economic problem for which no hard and fast rule can be made. Trouble arises when an inadequate bund is built on land which is too low. This shortsighted practice results in maintenance costs far in excess of the initial saving.

TIDAL CONTROL GATES

Tidal control gates present problems both of siting and of construction. On the open coast small outlets with intermittent flow are apt to silt up. A continuous flow favours the maintenance of deep water channels. Tidal control gates which discharge into river estuaries or large tidal creeks are much more likely to be successful than gates on the open coast. The control gates sometimes used to be sited in deep re-entrants in the bunds, so as to remain serviceable even if the bund had to be retired in the event of heavy coastal erosion. This arrangement is now avoided, because a channel within a re-entrant is likely to silt up solid.

The soil in which control gates are built almost invariably has the consistency of toothpaste. Until recently the standard technique was to construct in situ, in a flat sloped excavation with massive timbering for the final three or four feet of depth. This was troublesome and lately another technique has been developed. A paddock is prepared close to the waterway which is to be controlled. The floor of the paddock is slightly above low tide level, so that drainage is natural. The control gate, complete except for superstructure, is built in the paddock; at high spring tide it is floated into position and sunk on a bed, previously prepared without dewatering, in a natural creek. Backfilling is done by dragline excavator. In practice the process is not so hazardous as it sounds, although a pawang (magician) is sometimes in attendance to render professional service if disaster appears imminent. This floating culvert technique is usually the most economic method of constructing a tidal gate where the bottom of the drain is two feet or more below the average level of highest and lowest waters at, say, spring tides.

MECHANISATION ON THE ESTATE

Field drainage on the rubber estate usually connects with the system maintained by the Drainage Board concerned. The maintenance of both should be considered on a long term basis. Rising wages are leading to increased mechanisation and modern thought is turning more and more towards mechanised construction and maintenance of bunds and drains. In due course manufacturers may design machines especially for tropical conditions on rubber estates, but so for we are having to adapt equipment intended primarily for quite different purposes.

The best tool for maintaining large drains is undoubtedly the excavator, pontoon mounted or on crawler tracks, operated either as grab or dragline. Various types of bucket dredge have also been tried: one

popular make is pontoon mounted and discharges through shoots; another has crawler tracks and works its way along the bank with a bucket train cutting the side slope as desired. All these machines, and any others which we can foresee for the task, will require room to work. Estates have in the past been laid out with hand labour in mind for the tasks of digging and clearing drains, and trees were planted up to the edges. Now that replanting programmes are being planned, managers will do well to consider whether they cannot improve their drainage systems and allow more generous space alongside for future use of machines. A small excavator has a 20 to 30 foot boom and requires at least 10 to 15 feet width of bank on each side of the drain, for room to move and dump. This suggests a minimum cleared area 30 to 40 foot wide along the drain, depending on its size.

The eradication and control of weeds and grasses along drains and the slopes of banks may be done mechanically, by slashing, or chemically, by spraying. For most of these purposes, a light wheeled tractor can be an advantage, if a suitable path is provided along the drain. This can be conveniently constructed during desilting operations on the drain, if the banks are free of trees and other obstacles. Spraying can be undertaken whatever the state of the drain slopes, but most mechanical methods of removing or cutting weeds require reasonably smooth slopes, free of stumps. These conditions are obtained in practice when the drains have been constructed by machine.

The trend, therefore, is for cleared drain reserves which are wider than hitherto. The land thus lost to planting may well prove to be a long term economy.

R.L. Akers

Mineral Deficiencies of Hevea

Hevea may suffer from deficiency of mineral constituents in the soil. Symptoms on young seedlings grown under scientifically controlled conditions of sand culture in pots are described by Dr E.W. Bolle-Jones, and fully illustrated in colour by Mr Hoh Choo Chuan, in a paper 'Visual Symptoms of Mineral Deficiencies of *Hevea Brasiliensis*', which will appear shortly in the *Journal of the Rubber Research Institute of Malaya.*

Many of these symptoms have not – as yet – been observed in the field. We hope to deal with specific deficiencies as they concern estate practice in a series of future articles in *Planters' Bulletin.* Magnesium deficiency is widespread among young hevea in replanted areas, and is easy to recognise.

The new knowledge of symptoms has already revealed points of interest on estates. Thus, mild nitrogen deficiency has been seen among young and mature trees on coastal clay soils. Instances of potassium deficiency have been noted in Johore, Negri Sembilan and Perak. Iron deficiency symptoms appear in young seedlings in replanted areas on light, highly leached, sandy soils.

Secondary Leaf Fall

THE ANNUAL LEAF FALL KNOWN AS WINTERING is a striking and important characteristic of the rubber tree. In Malaya the main wintering season falls in the first four months of the year, coinciding with the dry season, usually being well advanced in the north of the country by the time that it begins in the south. Wintering is accompanied by a drop in yield which is only temporary provided that the trees refoliate promptly and there is no further loss of leaf. Before the new leaves become mature they may fall as a result of attack by fungi, mites and thrips. It is this loss of immature leaf which is known as secondary leaf fall, a term which therefore applies only after trees have reached the age at which they undergo wintering. It should not be confused with late or second wintering, which is the shedding of mature leaves during a dry season later in the year.

SYMPTOMS

Secondary leaf fall appears a week or so after trees have lost their old leaves, at the time of refoliation. The ground beneath the trees should then be watched for young shrivelled leaflets. When the wind is blowing, or a branch of a tree is shaken, leaflets can be seen fluttering to the ground. If a search is needed to find them, the attack may be regarded as slight; if they are easily seen once one is under the trees, the attack is moderate; if a pale green carpet of leaflets is to be seen on approaching the trees, the attack is severe. Looking up into the branches is of little help in assessing the severity of attack, as there will be many bare branches that have yet to refoliate. Mature leaves may be falling to the ground at the same time as diseased immature leaves where wintering has been prolonged; these old leaves must of course be ignored in assessing secondary leaf fall.

AGENTS RESPONSIBLE

The appearance of attacked leaves varies in detail according to the agent responsible for causing the leaves to be shed. The four organisms that contribute to secondary leaf fall, alone or in combination, are the fungi *Oidium heveae* and *Gloeosporium alborubrum*, the mite *Hemitarsonemus latus*, and the thrips *Scirtothrips dorsalis*.

Oidium heveae is the dominant cause of leaf fall. It was found first in Java in 1916, later in Uganda (1921) and Ceylon (1925), but was not confirmed in Malaya until 1928. A young leaf attacked by *Oidium* is shrivelled and blackened at the tip. On its surface, most usually along the midrib, can be seen shining white patches each of which is a colony of the fungus made up of fungal threads radiating over the leaf surface from a centre, with branches at intervals penetrating into the leaf tissue. Under favourable conditions the fungus produces an abundance of microscopic barrel shaped spores which are released into the air and so spread the disease. The spores may be blown long distances. When they alight on a leaf they germinate under conditions of high humidity and start an infection. Within a few days a very young leaf will fall. If the attack develops on a leaf the cuticle of which has already hardened somewhat, the leaf will remain on the tree and the

Part of an Oidium colony, much magnified. This illustration and the three following are all drawn to the same scale.

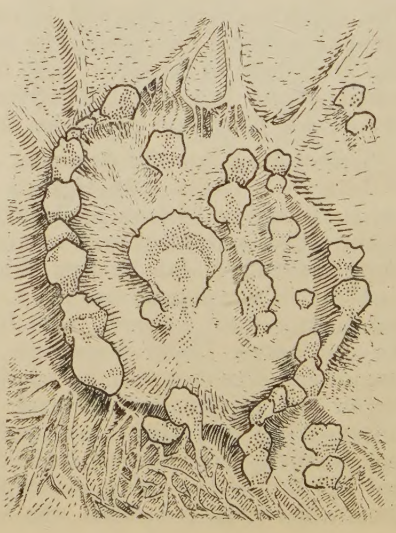
colony may spore heavily for several weeks, eventually drying up to leave a patch of yellow discolouration of the leaf tisue. *Oidium heveae* also attacks the flowers, causing them to fall with consequent loss of seed production.

There used to be speculation as to how and where the fungus maintained itself between the refoliation seasons. Analogy with the mildews of temperate climates led to a suggestion that the fungus 'hibernates' during the period when it is not obvious on the trees. This view cannot be justified, for a diligent search will reveal the fungus in an active state at any time of the year, and even sporing freely, on the shaded leaves of low branches or of self sown seedlings. The disease 'powdery mildew', described on page 77 of *Planters' Bulletin 13,* is significant only in that it maintains the fungus from one season to another.

Gloeosporium alborubrum is a widespread and important parasite of many tropical crops. On rubber it is responsible for a leaf disease (*Planters' Bulletin 24,* page 53) and a dieback (*Planters' Bulletin 20,* page 82). As early as 1915, thirteen years before *Oidium* was identified, it was recognised as causing a secondary leaf fall in Malaya.

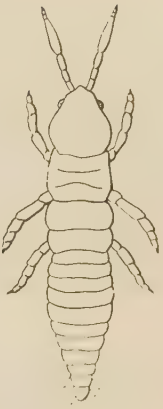
A very young leaflet attacked by *Gloeosporium* blackens, shrivels and falls. *Oidium* and *Gloeosporium* are superficially not dissimilar at this stage, but *Gloeosporium* produces, under damp conditions, pink or buff spore masses that are easily visible to the naked eye, all over the shrivelled surface. Leaflets that are older when attacked, though still immature, offer some resistance to invasion by the fungus, with the result that points of infection are cut off as discrete spots about one millimetre across. Such leaves may fall, sometimes with the tip withered. Older leaves that are invaded develop only pin prick lesions and do not fall.

The yellow tea mite, *Hemitarsonemus latus,* which is an occasional pest in nurseries, undoubtedly contributes largely to secondary leaf fall although it is not often solely responsible for the fall of young leaves from mature trees. A description of it is given on page 126



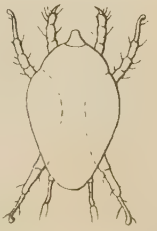
Spore masses erupting from a Gloeosporium spot on a leaf.

of *Planters' Bulletin 9.* The mites can just be seen with the naked eye. The adults are yellow green. The body of the female is about a fifth of a millimetre long, the male a little smaller; the larvae, which are smaller still, are translucent white. The eggs, large in relation to the size of the mite, can be easily recognised under a strong lens by having prominent white spots regularly arranged over their surface. Attacked leaves are pale green and shrivelled, with a wavy margin. The mite occurs on a wide variety of plants. Its numbers can increase very rapidly under favourable conditions, although populations are usually held well in check by natural enemies of which a predacious mite, a species of *Typhlodromus,* appears to be the most significant.



Adult female of the mite Hemitarsonemus latus.

The thrips *Scirtothrips dorsalis* is commonly associated with secondary leaf fall but not as the sole cause of it. The account of the pest published in 1935 (*Journal of the Rubber Research Institute of Malaya,* Volume 6, page 58) under the title 'Hevea Thrips' records complete defoliation resulting from thrips attack, but this is exceptional. A heavy attack will cause the entire leaflet blade to curl downwards into a scoop shape, though it is rare even to see this. The effect usually seen is that the veins are curved in towards the midrib, the development of the leaf lamina being partly suppressed. The thrips is much larger than the mite, the adult being one millimetre long from its head to the tips of its folded wings. The eggs are inserted into the leaf tissue. The first stage nymph that hatches out is white, and just visible to the naked eye. In the later nymphal stages the body is yellow, as is the adult. Thrips, like mites, are kept in check by predators of which the most important seems to be another thrips, a species of *Taeniothrips.*



First stage nymph of Scirtothrips dorsalis. The adult would be more than twice as large.

CLONAL SUSCEPTIBILITY

There are clonal differences in the time of wintering that give the impression of variation in susceptibility to secondary leaf fall. A clone that winters early will refoliate before the various parasites have become abundant. Conversely, a late wintering clone is more likely to suffer from them. Real differences in susceptibility between the clones that are widely planted in Malaya have not been established, though many specimens are closely examined every year. The frequency of occurrence of these specimens from different clones cannot be taken as indicating more than the extent of their planted areas; thus clone Tjir 1

heads the list, followed by PB 86 and Pil B84. The intensity of attack of the parasites is, however, noted for each specimen. Accumulated records indicate that the common clones differ little in their susceptibility, while unselected seedling trees (which are also older, of course) appear to be rather less affected by *Gloeosporium*.

Secondary leaf fall is perhaps too mild in Malaya for disease resistance to be obvious. In Ceylon, where *Oidium* is so much worse, the Java clone LCB 870 has been outstanding in this respect. Though its poor yield detracts from its immediate value, it has been used for breeding and top budding.

PREDISPOSING FACTORS

All four of the leaf parasites are to be found in any part of the country at any time of the year. It is not their distribution that determines differences in severity of secondary leaf fall from year to year, but climatic factors, affecting the organisms directly and also indirectly by controlling the timing and duration of wintering and refoliation. In general it is a good year when the dry weather holds during wintering, followed by rain when the trees are refoliating. Under these conditions both wintering and refoliation proceed rapidly and completely. In contrast, if rain falls after wintering has started, or if the refoliation period is dry, the leaf change is long drawn out and *Oidium* builds up rapidly. It would be wrong to suppose *Oidium* to be favoured by wet weather. In fact, it will not penetrate a leaf when the surface is wet. Infection occurs on dry leaves when the humidity remains near saturation point for several hours, as it can at night even during dry weather. *Gloeosporium*, which is more a wet weather disease, comes into prominence a little later, when *Oidium* infections become less.

CONTROL

Secondary leaf fall is not of sufficient importance in Malaya for control measures to be needed. The position is otherwise in Ceylon, where the severity of *Oidium* is combatted by routine sulphur dusting during the refoliation period, using power driven machines, which alone will throw the dust to the necessary height. Sulphur is, however, useless against *Gloeosporium*. Good control of *Oidium* has been obtained, but a consequence has been an increased amount of *Gloeosporium* and *Phytophthora* leaf diseases. No details about power dusting are given here because the procedure is not followed, apart from its exceptional use to protect the flowers in valuable seed gardens.

Rubber growing areas that are without *Oidium* (in West Africa and in South and Central America) are naturally concerned to exclude it. Malaya must also guard against possible fresh introductions lest the relatively small importance of the organisms causing secondary leaf fall here is due to our having less virulent strains. Though this is not the likely explanation (more probably Malaya's climate is less suitable for the development of leaf pathogens), routine phytosanitary precautions are nevertheless applied even to material imported from such near neighbours as Sumatra and Thailand. As a further precaution our

annual secondary leaf fall survey, started in 1931 and regularly maintained except for the war years, has been continued. Since 1948 it has taken the form of a circular sent to estates, requesting representative specimens from areas where leaf fall is occuring. A form is provided for recording information about each affected area, the specimens being numbered to correspond with the records. The state of affairs so far revealed is satisfactory. Should it change, the returns and specimens that we receive provide the means for our becoming promptly informed.

Sodium Chlorate, Weedkiller

INCREASING INTEREST has been shown during the last few years in the use of weedkillers which are not dangerously poisonous. Sodium arsenite is still the cheapest herbicide for most purposes, but a permit is needed to buy and use it, and it cannot be applied in areas where a water supply might be contaminated. Sodium chlorate is one of the best known alternatives and has recently come into prominence because it eradicates some species of grass which resist arsenite.

When used for spraying weeds, sodium chlorate acts mainly as a contact poison. Much of it is absorbed by the tissues of the plants above ground, although a little percolates into the soil. The usual rates of application are 15 and 25 lb/acre: the lower for controlling smaller grasses and the higher for general use. The herbicide is best applied in 100 gallons of water per acre, with about 4 ounces of a spreading agent added — Lissapol N, Teepol or Comprox A. Sodium chlorate is available locally as white crystals which dissolve readily in water (current price $50 per hundredweight bag).

Ischaemum muticum, creeping stem from which numerous shoots arise.

Spraying should preferably be done during a spell of dry weather.

Sodium chlorate can also be used as a temporary soil sterilant, in quantities of 2 cwt/acre or more. At this concentration it kills rubber trees, as well as other plants. But this is ten times the concentration which is employed in normal estate practice for spraying, when the amount which gets into the soil is too small to damage any hevea in the vicinity. Sodium chlorate is not fixed in the soil but decomposes: rain water leaches it through fairly rapidly.

SPECIAL ADVANTAGES ON THE ESTATE

Sodium chlorate is particularly effective against *Ischaemum muticum*, commonly called bamboo grass. In one experiment we found that a single spraying at 15 lb/acre prevented regeneration of growth for four months. On the other hand we have had reports that two or more sprayings at 25 lb/acre were required to eradicate the grass. The difference is probably due to weather conditions at the time of spraying. In spite of this variability of effectiveness there can be little doubt that the cheapest way to eradicate *Ischaemum muticum* is to spray with sodium chlorate. This grass is frequently found in drains on coastal estates.

Grasses which resist sodium arsenite include *Panicum* species, particularly *Panicum nodosum (Hemigymnia fusca)* and *Panicum sarmentosum*. Sodium chlorate is especially effective against *Panicum nodosum*, at the rate of 25 lb/acre.

Against other weeds the use of sodium arsenite is to be preferred on grounds of economy, but when the weed population is mixed there is a lot to be said for spraying first with one weedkiller, and then with another on the next round. This employs the selective effectiveness of sodium chlorate against resistant grasses to the best advantage.

Flower heads on Ischaemum muticum.

Lalang can be eradicated by repeated applications of sodium chlorate at the rate of 25 lb/acre, but the use of a herbicidal oil is almost always better, because it is cheaper. We are not certain as to the optimum concentration of sodium chlorate for killing bracken or stagmoss, but a solution of 20 to 25 lb in 100 gallons of water should kill those portions of the weeds which are above ground. Complete eradication would need several applications.

Sodium chlorate finds a special use for spraying small grasses in the weeded strip along planting rows, where arsenite might damage the young rubber trees. Accidental contact of small quantities of the spraying solution with the bark of young trees is not likely to cause serious damage. This justifies the extra cost.

CAUTION

The herbicide has the advantage over sodium arsenite in that small quantities of it are not poisonous to man or beast, but it has also one

important disadvantage, apart from cost. When sodium chlorate is mixed with organic matter a potential fire hazard is created. When vegetation dries out after spraying with chlorate, it may catch fire easily and burn rapidly. The risk is not great unless the weather is very dry and hot. Fortunately sodium chlorate is hygroscopic, and the humidity of the Malayan climate helps to keep sprayed vegetation from drying out completely.

Labourers are likely to be badly burned if they allow the solution to dry on their clothing. They must certainly not stand near a fire when wearing clothing that has been soaked in sodium chlorate spray. The fire risk can be reduced by adding calcium chloride or sodium borate to the herbicide, but such formulations are not in general use in Malaya.

R. R. I. News

Malformation of stem and root caused by planting a seed in the position shown : seeds should always be planted horizontally, with the flat face downwards.

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Trials to determine whether the use of the weedkiller Dowpon (Dalapon) has any harmful effects on young hevea continue, on a number of clones.

In an experiment where seeds were planted between trees of an old stand which was poisoned at various times afterwards, it was found that the longer the old stand was left, the slower the growth of the new stand, and the greater the response to added nitrogen.

o

Nitrogen or phosphate manures appear usually to increase seed production, while application of potassium reduces it.

Skim Rubber

This information is provided by the courtesy of the Director of the Research Association of British Rubber Manufacturers, Shawbury, Shrewsbury, Shropshire, England.

Skim rubber, more available now than a few years ago, has been giving manufacturers some trouble. The Research Association of British Rubber Manufacturers have therefore undertaken to investigate how best it can be utilised. To this end we sent some twentyone samples of skim rubbers from Malayan estates to England, and the R.A.B.R.M.

have sent us results of their preliminary study of the curing and scorching behaviour of skim rubbers, as compared with pale crepe and RSS 1 (Yellow Circle). Except for four samples which were specially treated to reduce abnormality of the finished rubber, the rest were prepared on different estates according to their usual practices.

The excessive scorching, for which most skim rubbers are reputed, was found in compounds with an acidic accelerator (MBT) but not when a basic one (butyraldehyde aniline) was used. With the latter type most of the skim samples cured no faster than ordinary smoked sheet or crepe, nor was there more scorching. Even with the acidic accelerator, the ratio of scorch rate to cure rate was usually no greater than with normal rubber – the mixes are scorchy simply because they cure quickly – but neither rate could be reduced to normal by using less of the accelerator.

The special treatments which had been used to reduce the amount of non-rubber constituents in a few of the samples appeared to be effective in modifying scorch and cure rates towards normal. Practically all of the samples gave harder, stiffer vulcanisates than normal rubbers regardless of the type of accelerator.

Analysis of the samples suggested that the copper content of skim rubbers varies greatly, and is sometimes excessive. Accelerated ageing tests on the vulcanisates of all samples did not show unduly bad ageing, so that the copper present may not be in a very injurious form.

Variability appears to be the main drawback of skim rubber. But the scorching trouble can be obviated, and some of the effects of the variability can be evened out, in 50/50 blends of skim rubber with GR-S; at the same time the slow curing rate of the GR-S is improved.

So far the use of skim has presented considerable problems to the manufacturer, but the R.A.B.R.M. hope that, as a result of work in their own and other laboratories, a lead will be found to its ready use in the factory.

Antibiotics from Skim Serum?

As a sideline of our microbiological work on latex it has been found that skim serum and sheet serum, which are run to waste in Malayan factories, serve as a good basis for cheap media in which bacteria can be grown. On a laboratory scale many varieties of bacteria can be cultured and certain antibiotic effects demonstrated. This suggests the possibility of the commercial production of antibiotics or vitamins locally, but many technical difficulties would need to be overcome before even a pilot operation could be achieved. At present the discharge of latex serum into rivers often contaminates water used for factory cleansing. Mr D.H. Taysum describes recent work at Sungei Buloh in two papers entitled 'A Medium for the Cultivation of Bacteria from *Hevea* Latex' and 'Bacterial Culture Media from Waste *Hevea* Latex Sera', appearing in the *Journal of Applied Bacteriology*. The former paper gives a precise technique for counting the living bacteria of *Hevea* latex, ammoniated field latex and fully ammoniated latex concentrate. A technique for counting the total of both living and dead cells has yet to be devised.

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Rubber Developments

The latest information on new processes as well as uses of natural rubber appear in the quarterly *Rubber Developments*, which is designed for consumer and manufacturing readers. With the increasing interest on estates in meeting consumers' needs by the production of special rubbers and by new packing methods, and with the ever widening scope for local manufacture, readers of *Planters' Bulletin* will find many articles of interest and value in this publication.

In Malaya, *Rubber Developments* is available gratis on application to: The Manager, The Natural Rubber Development Board, Post Office Box 666, Kuala Lumpur.

The Natural Rubber Development Board issue a wide range of technical and semi-technical literature on various aspects of natural rubber; a full list can be obtained from the above address.

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